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ABSTRACT

The cost-effective use of communications technologies to extend adult learning opportunities is one way state policymakers can face the challenge of responding to growing demands for essential public services. The major new educational technologies that are available are television, radio, telephone, computers, communications satellites, and hybrid systems. Advantages to be derived from their use fall into seven categories: cost savings, ease of use, time-free/space-free convenience, usefulness to a diversity of learners, program quality, accelerated learning times, and improvement of the efficiency of noninstructional services. Factors that inhibit the expanded use of the technologies are startup costs, resistance from those with a vested interest in the status quo, need for staff development, lack of consumer readiness, inequitable access, technical limitations of the devices, political/ideological considerations, public policy restrictions and implications, and need for more research. Of the possible state roles in promoting the use of the new technologies, state goal setting is particularly important. Once a state goal has been defined, a systematic approach should be used in the application of cost-effective instructional technologies to the achievement of that goal. (YLB)

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Lifelong Learning Project

EDUCATION IMPROVEMENT CENTER
Education Commission of the States
1860 Lincoln Street, Suite 300
Denver, Colorado 80295

ADULT LEARNING INNOVATIONS: VEHICLES FOR SOCIAL AND ECONOMIC PROGRESS

by William J. Hilton

July 1982

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The Education Commission of the States is a nonprofit, nationwide interstate compact formed in 1966. The primary purpose of the commission is to assist governors, state legislators, state education officials and others to develop policies to improve the quality of education at all levels. Forty-eight states, American Samoa, Puerto Rico and the Virgin Islands are members.

It is the policy of the Education Commission of the States to take affirmative action to prevent discrimination in its policies, programs and employment practices.

ENHANCING THE STATE ROLES IN LIFELONG LEARNING

The phrase "lifelong learning" expresses an ideal in which Americans of all ages, throughout their lifetimes, would be able to move easily in and out of learning opportunities that help them acquire the knowledge and develop the coping skills so essential to independent living in our complex, highly technological society. Each year, millions of adults pursue this goal by enrolling as full- or part-time students on college or vocational school campuses, attending seminars and workshops at various sites within their communities, participating in training programs at their places of employment, taking television courses, engaging in independent reading and study projects, and signing up for correspondence courses.

In recognition of the fact that the states have the constitutional responsibility for the planning and delivery of education services for citizens of all ages, the W. K. Kellogg Foundation has awarded a three-year grant to the Education Commission of the States (ECS) in an effort to facilitate planning and policy development activities in this area. That grant supports the operations of the ECS Project on Enhancing the State Roles in Lifelong Learning, which works with state education leaders in California, Colorado, Illinois, Kansas, New York and Ohio, as they plan for the extension of adult learning services. Twenty-seven other "associate" states have also been closely identified with the project and have designated representatives to serve on a national technical task force (TTF), in which forum the states exchange information and experiences regarding their

activities on behalf of adult learners.

This paper is one of a series of materials developed under the project that draws upon the experiences of the project states in clarifying the roles that states might play in this critical area. Evaluative feedback regarding the usefulness of this publication, as well as requests for additional copies, should be referred to the Education Programs Division, Education Commission of the States, 1860 Lincoln Street, Suite 300, Denver, Colorado 80295.

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EXECUTIVE SUMMARY

In the face of unprecedented federal budget cuts, state spending ceilings and a generally poor economy, state education leaders are being challenged to meet a burgeoning need for adult learning services. Many forms of adult learning deserve a high priority on state education policy agendas because the development of "human capital" is critical to the long-term viability of the states. But most states now find themselves in the ironic circumstance of not being able to afford that which will ultimately bring them greater wealth.

This paper advocates the adoption of two approaches toward alleviating that problem.

First, states are urged to make more extensive use of electronic media in the delivery of adult learning services. Experience in the use of television, radio, telephones, computers and other modern communications devices indicates that these technologies represent both cost-effective and learning-effective means of reaching virtually unlimited audiences of learners. While the use of these mediated instructional approaches probably will not enable states to reduce their current financial commitments to education, it could make it possible for states to serve many more learners without a proportionate increase in expenditures.

Most states have already made a considerable capital investment in one or more of these technologies, but the tendency has been to underutilize these resources in preference for more labor-intensive, traditional modes of instruction. While the

focus of this paper is specifically adult learning, these resources can be used with equal success in serving learners of all ages, and their use on the broadest possible scale will further enhance their cost-effectiveness even more.

The greater use of the new technologies for instructional purposes is not being proposed here as a replacement for traditional education delivery systems; rather, it is a highly cost-effective complement to those systems. It could significantly reduce the overall cost of delivering education services in the long run.

The second approach calls for insuring that limited education dollars are carefully targeted upon the highest priority needs within a state. The importance of state-level goal setting in establishing those priorities is highlighted, as is the importance of insuring that state leaders select the least costly alternative toward achieving those state goals.

INTRODUCTION

State policy makers today face what might well be their biggest challenge in modern history: they must find some way to respond to growing demands for essential public services, despite shrinking resources. In essence, these demands call for a greater return on every public dollar invested in the delivery of human services. This paper explores a way in which that challenge might be met through the cost-effective use of television, radio, telephone, computers and other electronic media to extend adult learning opportunities.

As a result of the many advances that are being made in the use of new communications technologies in education, we now have the means to provide qualitative instructional services to vast numbers of students of all ages. We are not suggesting that the use of these media will necessarily reduce the current cost of education services; rather, their more widespread use could enable states to accomplish more with their limited education dollars.

This paper is not a technological treatise to explain the often intricate workings of the new technologies, nor is the intent here merely to extoll the virtues of using electronic media for instruction. Rather, we will seek to answer the following key questions:

1. What are the new technologies?

2. What are the advantages of their use?

3. What factors inhibit their greater use?

4. In light of current fiscal realities, what roles could states play in promoting the greater use of the new technologies?

All of the new technologies are merely tools, means to an end, but not the end. Many advocates for the greater use of these technologies are so enamored of their potential that they lose sight of this. When that happens, states might be urged to spend more money for innovative instructional modes than is necessary.

It is important to relate the available innovations to state goals that have the highest priorities. In order to benefit from these innovations, state education leaders should: 1) clearly define goals that might best be addressed through the extension of adult learning opportunities, and 2) support the selection and implementation of the most economical instructional strategies available in order to achieve those goals.

THE NEW EDUCATION TECHNOLOGIES

Over the past half century, Americans have experienced a revolution in communications technologies that directly affects their lives, especially the way we are educated. Following are brief descriptions of the major new communications technologies that are available in extending adult learning opportunities.

Television

There are more televisions (TVs) in the U. S. than there are indoor toilets. While television programming today is heavily oriented toward entertainment and information, a significant minority of its offerings ("telecourses") are designed specifically to allow viewers to earn academic credit toward certificates or degrees. It should be noted, however, that the vast majority of those who watch such courses are not primarily interested in achieving any academic credential. For every one person who enrolls in a telecourse for academic credit, 20 others merely view the broadcasts for their personal edification.

Television is used for education more extensively at the local level than on a national scale. A 1979 survey by the Corporation for Public Broadcasting (CPB) revealed that 71 percent of the colleges and universities in this country use television for instruction, primarily at the undergraduate level, where enrollments are largest and where it is most cost effective. Local television instruction includes the closed-circuit video transmissions commonly found on large high school and college campuses: Instructional Television Fixed Services (ITFS), which

provide line-of-site transmissions over distances of up to 20 miles; and cable television (CATV), which are multichannel, local networks to which residents subscribe. Increasingly, CATV systems are interactive, in that they allow viewers to communicate answers to "Yes" or "No" questions posed by a broadcaster.

Other variations of television available for education uses include "Slow Scan TV," a relatively low-cost technology in which still pictures (instead of motion pictures) are transmitted over a television screen, along with a sound track; "videotex" ("teletext"), in which literal and numerical information is delivered on the TV screen either as a supplement or a replacement for pictures; "videotape," on which audio and video information are stored in tape cassettes for replay on a television monitor; the "electronic blackboard," in which information written on what appears to be a standard blackboard in one location appears on one or more television screens in remote locations, accompanied by a sound track of the person who is writing upon the blackboard; and the "videodisc," a device that resembles a phonograph record, with audio and video signals on its surface that produce a television program once it has been placed on the turntable of a laser disc player.

Radio

Even though it is much more cost effective than television and has a longer history, radio has not been used as extensively as it can be for education. It is widely believed that the popularity of radio has been eclipsed by television, but Americans

still buy and use more radios than television sets; and in other corners of the civilized world, where television is less common, radio is the primary means of transmitting information, entertainment and instruction.

The radio has several important advantages over television: 1) it costs much less; 2) it is not as wholly distracting to its audience (one can engage in a wider range of other activities while listening to radio than while viewing television); and 3) it permits mobile reception (people traveling in cars or buses can participate as readily as those at home.)

During the early years of radio, frequency allocations for education were extremely limited, and it was not until the expanded use of the higher frequency FM broadcasts that this situation improved. Today, National Public Radio (NPR), an organization of the nation's public radio stations, has successfully been promoting the development of education radio. Courses by radio are quite common and are usually supplemented by telephones (students contact their instructors, often using a "call in, radio talk show" approach) and by instructional materials printed in local newspapers.

Low power radio stations are used as communications links on high school and college campuses in much the same way as closed circuit television networks.

Telephones

Telephones have been widely used for instruction and are both cost effective and learning effective. On the telephone, the

learner can ask a question and get an answer as easily as in a face-to-face classroom exchange. The learner does not have to be in a classroom, and the instructor could be thousands of miles away.

Telephone courses are being used by many colleges and universities across the country, and a growing number of states (for example, Wisconsin, Kansas and Illinois) are adopting statewide systems of delivering information and instruction by this medium. The system operated under Wisconsin's Cooperative Extension Program, primarily offering noncredit instruction to local citizens, is the oldest and one of the largest in the nation. The Kansas "Telenet" system, at the University of Kansas in Manhattan, offers both noncredit and credit courses from high school through graduate school. The system at the University of Illinois is primarily used for communication and a number of cooperative extension courses.

The Cono Educational Network (CEN) in Walker, Iowa, provides telephone instruction to students enrolled in grades 9-12 in four schools. Both teachers and students in this network have praised the system, saying that telephone instruction helps them to be more attentive while listening and more precise in organizing their speech.

In addition to being used for instruction, telephones link groups of conferees "teleconferencing" ("telebridging") and communicate short, taped messages or lessons to those who call a designated location. Twenty-four-hour telephone services are often maintained to permit distant learners (those who might be

taking radio or television courses) to call in questions. Telephone lines are used to transmit documents, as in modern telecopiers ("facsimile machines") and teleprinters.

Exciting advances are still being made in the use of telephones for information and instruction. The American Telephone and Telegraph Company (AT&T) has already pilot tested a "picturephone meeting service" in 12 cities across the country that will use a combination of satellite and telephone line technology.

Computers

Computers are electronic devices that store, manipulate and retrieve data. They operate by translating literal and numerical information into electrical impulses (somewhat like the dots and dashes of Morse Code), and processing these at an incredible speed, according to a predetermined set of instructions ("program"). Computers themselves are generally referred to as "hardware," while the information they convey (captured on punched cards, magnetic tapes or discs) and the instructions that guide the operators of the machines are called "software."

Computers come in three sizes: mainframes, which have tremendous processing, storage and output capabilities, and are large enough to fill an entire room; minicomputers, which are more compact and have a smaller production capability; and microcomputers ("personal computers"), which can sit atop a desk and are being widely used with or without a hookup to a larger computer for a variety of small business, entertainment, household

financial management and education purposes.

It has been estimated that there are at least 90,000 microcomputers in our schools and colleges today, and at least one million of these units have been sold to individuals for home and business use since 1977. Sales of home computers in the U.S. totaled $200 million in 1981, are expected to reach $800 million by the end of 1982 and could total as much as $2 billion by the end of 1983. The computer is the newest, most glamorous, most publicized and, in many ways, most controversial of the new communications technologies, largely because of the concern that its greater use will lead to the depersonalization of education.

Computers are highly effective learning devices, in part because they are interative, and because their software can often be tailored to meet individual learning needs. They have been used in teaching both the very young and the very old with equal effectiveness. Computer output can be presented in many languages, and the software can be developed in a way that avoids psychologically harmful race and sex stereotypes. Special computer services have been developed to insure access by handicapped persons. For example, computers have been developed that aid blind persons by scanning printed material and reproducing the information in Braille.

Computers are being used today for a variety of instructional and administrative purposes. They are used to teach such subjects as reading, writing, mathematics, history, social studies and music (in which computers can be used in constructing musical compositions). They are also used in training simulations, as

when a mock control panel is used to train future jet pilots. They can also be used to deliver career and education guidance information (Hilton, 1982). They are critical to most of the research under way today. Administratively, computers are widely used in general office management, payroll disbursement and recordkeeping tasks. Computers are also being used by training staffs in large organizations, such as the Bell Telephone System, to produce training manuals (via word processing technology), color slides and other instruction materials that might be used in the delivery of instructional services (Rosenberg, 1982).

Progress in the use of computers for education is often hampered by a lack of adequate software. Much of the software that is available is being produced by such private firms as Apple, Texas Instruments, Borg Warner, Radio Shack and Commodore International. The Control Data Corporation, which developed the Programmed Logic for Automatic Teaching Operations (PLATO), is generally recognized as the most widely used computerized instruction system in the world, providing access to over 800 courses in 25 disciplines. Many colleges offer credit for PLATO courses, and many business firms contract for personnel training with this software.

Aside from purchasing commercially available software, schools and colleges are relying increasingly upon programs that are developed by their own faculties and upon modifications of commercial software. In contrast to times past, computers are so easy to program these days that most individuals can easily do it. In this way, the added cost of installing computers in education

settings can be greatly reduced or eliminated, and the flexibility of these systems can be greatly increased.

Communications Satellites

Satellites are electronic devices that have been launched into orbit around the earth in order to facilitate long distance communications. Their use in transmitting education programming could virtually eliminate problems of access to further learning opportunities for citizens of all ages, whether they live in crowded urban centers or sparsely populated communities. Most international, long distance telephone calls, as well as most of broadcast television, depend upon satellites. The satellites pick up radio signals that originate at "uplink" facilities on the earth's surface, amplify those signals electronically and then retransmit them to "downlink" reception stations on earth.

A chain of about 80 satellites currently rings the earth's equator. At an altitude of 22,300 miles, these automatons travel at the same speed at which the earth revolves, appearing to be stationery, in a "geosynchronous orbit."

One of the most modern satellites can receive and retransmit messages from 43 percent of the earth's surface at any given moment. It is the scope of these extraterrestrial devices, combined with their relative economy as "repeaters" of vast amounts of information, that makes them far superior to other communications technologies that are dependent upon traditional landlines, microwave towers and undersea cables.

The antennae used to transmit and receive information via satellites consist largely of concave, circular structures

constructed of fiberglass and sprayed aluminum, popularly referred to as "dishes". The more powerful the orbiting satellites, the more costly it is to launch them. However, more powerful satellites means that the dishes on the ground can be smaller and relatively inexpensive. Hence, the move to larger satellites ("complexity inversion") means that individual citizens will be able to install small dishes in their backyards and receive, free of charge, television programming that originates at locations around the globe, including first-run movies and broadcasts intended for citizens in other countries.

Personal ownership of satellite receiving equipment is the backbone of the Direct Broadcast Satellites (DBS) movement. The Communications Satellite Corporation (COMSAT) has been authorized by the Federal Communications Commission to begin marketing its own personal dishes in 1983, and a number of individual entrepreneurs have already begun to do this . DBS threatens to undermine all commercial and public radio and TV broadcasts, as well as CATV, but it also has the potential of becoming a powerful education tool.

Hybrid Systems

The five technologies described above do not always function as mutually exclusive avenues to learning. They are increasingly used in combination with each other, as well as with other, more traditional learning approaches, such as textbooks, classroom lectures and chalkboards. Sometimes the technologies are combined in order to create an integrated learning system; i.e., a system that uses a variety of passive and active audio and visual

techniques in communicating knowledge. For example, only 30 percent of the typical telecourse is televised instruction; the rest relies heavily upon published study guides, textbooks and faculty/student interactions in class, through correspondence and via telephone. Because of the growing popularity of computers in the schools, textbook publishers have become acutely aware of the need to effectively integrate computer software developments with their traditional publications, though financial considerations have slowed progress in that area.

Another example of the combination of the new technologies can be seen at Miami-Dade Community College, where a computerized guidance service ("RSVP") augments telecourses at that campus. Telephone answering services supplement the instruction uses of television, radio and computers. The use of satellites in transmitting television programs is an obvious example. SATCOM I, a communications satellite, distributes video programming through CATV systems. The videodisc is a combination of computer storage and television technology.

Conclusion

The new technologies have had the greatest impact in those fields that are most labor-intensive, because they eliminate the need to have many people performing essentially the same operation. A small team of college faculty could design and produce key segments of a television course ("telecourse") that could be used with appropriate supplemental materials for years (repeated use enhances cost effectiveness), and delivered to students of all ages around the country (making the material

useful to many audiences also insures its cost effectiveness). This would eliminate the need for hundreds of history teachers to teach the same material. Since faculty salaries are the biggest expense in our traditional, labor-intensive delivery system, a major reallocation of resources could occur.

The apparent impact of such an accomplishment upon the ranks of unemployed teachers need not be as dramatic as it might appear at first glance. At least theoretically, many of those displaced by this technological advancement, if they are sufficiently flexible, can find employment in other aspects of teaching. They could write telecourse scripts, research the information presented in those scripts, assist in various aspects of production and serve as narrators.

This is not to suggest that concern about technological displacement, generally recognized as one of the major impediments to the expanded use of the new technologies, is invalid. This human dimension of our technological age has been hotly debated for years, and innumerable examples have been cited in the literature to show that technology either does or does not contribute to our national unemployment problem (Miller, 1981, and Servan-Schrieber, 1981).

Some instructors might well have to switch to entirely new careers, but that is not necessarily bad. Not everyone in any given career is there by choice or is suited only to pursue that particular career. Technological advancements could have a liberating effect upon many professionals whose horizons are limited in their current fields.

THE ADVANTAGES OF THE NEW EDUCATION TECHNOLOGIES

The advantages to be derived from the use of the new technologies fall into eight categories: 1) properly used, these technologies are truly more cost-effective approaches toward delivering certain types of instruction; 2) the technologies are becoming increasingly easy to use; 3) they foster greater personal convenience in the learning process; 4) they are useful by a diversity of learners; 5) they can help to enhance the overall quality of education services; 6) they save valuable time during the learning process for both instructors and learners; and 8) they help to improve the efficiency of noninstructional services. Each of these advantages is elaborated upon below.

Producers and users of the new technologies are making significant progress in the area of maximizing their cost effectiveness, and states should encourage and support such efforts. Institutional users of telecourses, for example, are often organized into consortia for sharing the cost of producing and utilizing these instructional aids. States using telephone instruction systems also are beginning to share resources and expertise across boundaries in order to minimize costs.

As more elementary/secondary schools acquire technologies such as computers, consortia might be established within or among school districts or even on a statewide basis for cost efficiency. Since consortia typically provide staff development and clearinghouse services, they could help to promote computer literacy among teachers, to make certain that schools make wise

selections of equipment, and to make certain that both hardware and software are used to the maximum advantage.

Cost Savings

Despite the initial high cost of producing or acquiring instruction hardware and software, it is clear that mediated instruction is far more cost effective than traditional, more labor-intensive forms of education. Learners are able to benefit from that fact as much as the sponsors of education services (if not more), with the result that many adults will be better able to afford to pay for these services out-of-pocket, thus reducing the need for public subsidies of education services.

It has already been noted that, by replacing some faculty with machines, the new technologies can reduce salary costs considerably. Other cost savings include the following:

1. Per-student overhead is low because learners pursue their studies in their homes or at least at noncampus facilities.

2. The learners thus save the high cost of transportation to and from a campus.

3. Campus energy costs would also drop in proportion to their total enrollments, since distant learners would not require an increase in the number of classrooms to be heated or air conditioned.

It has been estimated that the cost effectiveness of using the new technologies doubles every two years (Stolurow, 1981).

Ease of Use

Those technologies that bring learners into direct contact with specialized equipment, such as computer terminals, have been made easier to use. (Computer experts talk about making their machines more "friendly.") In the computer industry, applications software ("canned" programs) exist for nearly every major purpose for which computers might be used, thus eliminating the need for complex and time-consuming software development. Instruction manuals are easily readable and understandable; computer output on television monitors has been made less tiresome to the eyes; and the process of programming computers has been made simpler.

In addition to simplifying the use of these innovations, these reforms make it easier to train large numbers of teachers and students in the proper use of the equipment and speeds public acceptance of their use.

Time-Free/Space-Free Convenience

Aside from their greater emphasis upon electronic transmissions, the newer technologies are distinguished because they are not "setting based". A learner does not have to be in a particular setting, such as a classroom, at a particular time in order to derive maximum benefits from it. They are space free and time free, and thus are commonly identified as the mainstays of an open learning movement that began in the 1950's, offering greater freedom and control for learners in their choice of what, when and

how they learn. Such a philosophy is compatible with the needs and interests of adult learners.

Useful by a Diversity of Learners

Often, the cost effectiveness of new technologies is directly related to their widespread use. Hence, while this paper focuses on new technologies for adult learning, cost-conscious states should consider extending, as appropriate, these innovations to help meet a full range of education needs.

However, state planners should recognize that not all learners can benefit maximally through the use of the new technologies. The software for these devices is probably most useful in "limited range of right answer" learning ("When did Columbus discover America?"), than in "multiple right answer" learning ("Why is life so complicated at times?").

One observer suggests that persons lacking basic academic skills would benefit more from learning in a classroom setting than with open learning approaches. It has been suggested, for example, that minority group students, who tend to lack adequate early school preparation, have been under-represented among students who are learning with the aid of television (Richardson, 1980). The possibility also exists that White, middle-class teachers, unable to communicate effectively with minority group members, might foist upon them the use of these new technologies in order to avoid interpersonal contact. No group of learners should be automatically excluded from the use of any of these technologies, and proper safeguards should be established to

insure that abuses do not occur in the manner in which these resources are deployed.

Program Quality

We already know that some instructors are more effective presenters of information than others and that certain instruction formats are more compatible to particular individual learning styles than others. Use of the new technologies would enable us to capture and replicate on the broadest possible scale those exemplary communications styles that are most qualitative.

Other ways to improve quality might include:

1. These technologies can help to eliminate busy work for instructors. As John Strange (1981) notes, they would be freed to teach the "cognitive, affective and interpersonal skills, and those essential mathematics, writing and communications skills" that are so often neglected.

2. Technologies permit self-paced, individualized learning and enhance learning performance. The devices are patient with slow learners and tireless in their ability to reaffirm positive learning behaviors.

3. When faculty develop and evaluate software, they gain important insights into the essentials of effective teaching and are able to improve their own teaching skills immensely.

4. The cost-effective use of these technologies often frees up resources that could be used to subsidize less profitable, more specialized modes of instruction, as in certain graduate-level programs.

5. Where classroom instruction is used, the quality of those interactions might be enhanced if the campus can afford to have <u>smaller</u> classes, because these are, in effect, being subsidized by the mediated instructional activities.

6. Instruction via the new technologies will enable many campuses to operate with fewer faculty members, a condition that will likely be necessitated by declines in traditional student enrollments.

Are these instructional approaches as effective as other modes? Research by Milton Ohmer (1952) suggests that they are, and a 1968 Kansas study in support of that state's use of instructional telephone revealed "no significant difference in the amount of learning that took place when educational information was presented to the adult audience by means of face-to-face and the remote teaching technique" (Blackwood and Trent, 1968). This view has been echoed by researchers who have attempted to assess the impact of particular technologies. Chicago's TV College research suggests that "homeviewers tend to surpass the performance of their on-campus counterparts who are comparable in age and ability" (Willis, Masiko and Erickson, 1960).

Students like the new technologies, according to evaluative research. Learners particularly praise their convenience and the fact that the courses lack the time-wasting digressions so common in college lectures. Older, more mature students tend to be even more satisfied with these innovative modes of learning than the young (Willis, Masiko and Erickson, 1960).

On the other hand, quality often is perceived as a matter of process, rather than of outcomes. Hence, many observers are skeptical of the quality of nontraditional means, even if it is clear that the desired outcomes have been achieved.

One commonly accepted criterion of quality, usually applied to vocational training programs, holds that, if students are able to obtain and retain jobs after completing training programs, they have obviously had high-quality preparation. In support of this view, Control Data Corporation reports that it has a placement rate of over 80 percent among the trainees who complete its computerized vocational training programs.

Accelerated Learning Times

Mediated instruction has been found to require significantly less time than instruction through traditional classroom formats. Control Data Corporation reports that, while 150 hours of instruction are normally required to move students one grade level, 20 hours on its PLATO system are enough.

Christopher Dede (1981) has suggested that the new technologies could make it possible to teach a modern day curriculum in one-third the time that would otherwise be required,

and savings in time translate into savings in expense for both the education sponsor and the learner.

Improving the Efficiency of Noninstruction Services

As important as the new technologies are for instruction purposes, they serve other important purposes as well. They improve administrative efficiency, the conduct of research and the provision of essential student support services. Computers aid administration by automatically handling many record-keeping, test-grading and other time-consuming functions. Teleconferencing, electronic mail and computer searches of bibliographic materials help to save the time of faculty, administrators and learners. Telephones and computers facilitate two-way communication between teachers and distant learners, and permit the delivery of critical education and career counseling services to thousands of learners and prospective learners.

Conclusion

While there are many advantages inherent in the more widespread use of the new technologies, the author is not advocating the subrogation of current education delivery systems by this open learning approach. The choice is not one of either/or. Instruction via these new technologies is not ideally suited for all learners or for all education purposes. Such instruction must be regarded as being complementary to the existing systems. As a highly cost-effective complement, it will greatly reduce the overall cost of providing education services to an expanding audience of learners.

FACTORS THAT INHIBIT THE EXPANDED USE OF THE TECHNOLOGIES

Before states can expand the use of instruction technologies, they will have to deal with some preliminary concerns: 1) the initial cost of the services; 2) resistance from those who have a vested interest in the status quo; 3) a need for staff development to insure the effective use of these resources; 4) a lack of consumer readiness for many of the more advanced technologies; 5) inequitable access to the technologies; 6) the need for more research into the implications of an expanded use of these media; 7) technical inhibitions related to the nature of the devices themselves; 8) public policy restrictions and limitations; and 9) political/ideological considerations.

Startup Costs

The initial cost of these services is a primary deterrent to their more extensive use. While the per-unit cost has been dropping as a result of mass production, the total cost of making these resources available on a statewide basis is prohibitive in today's economy. Were it not for the tremendous capital investment that has already been made in our traditional education delivery systems, the new technologies would be easily affordable by a country that is as wealthy as ours.

We are bound economically to the status quo. Our challenge is to devise reasonable strategies for financing the gradual development of a complementary technological instruction system without eradicating the essential components of our present

system. Webster (1975) suggests these strategies:

1. Start a new delivery system only where it represents the most cost-effective alternative to an existing system.

2. Make maximum use of existing facilities before investing in extended services.

3. Purchase hardware and software in volume when possible, in order to reduce the per-unit cost.

4. Fit the technology to the actual level of need. Slow Scan TV, while less glamorous, might serve the purpose as well as a full-color, motion-picture production.

The development of high-quality software can be quite expensive. Telecourses that typically include 26 to 30 half-hour televised segments could cost $200,000 to $600,000 to produce. At least one of them ("The Growing Years," by Coast Telecourses in California) cost one million dollars! Generally accepted strategies for reducing the cost of software production include:

1. Develop the software for repeated use by a wide variety of audiences, to maximize its cost effectiveness.

2. The software should be modifiable so that it will win the allegiance of faculty who will eventually approve its acquisition and use. However, too much customization raises the cost of these technologies because of faculty time invested in refining the materials. Hence, a

balance must be struck in the amount of flexibility that is built into the software.

3. The technologies can be used in serving both on-campus, traditional student populations and in reaching distant learners. For traditional students, it is an add-on cost. When it is used to expand both the long distance audience and the funding base, it is more cost effective. Hence, software should be designed with the needs of new markets in mind.

The Modern Luddites

At the dawn of the industrial revolution, Luddites, fearful of change, stormed factories and destroyed equipment in a futile attempt to reverse the wheels of progress. Reference has already been made to the widespread fear among college faculty of technological displacement. The prospect of employment losses because of declines in traditional student enrollments is damaging enough in itself. This new threat could spark even more resistance, because, unlike the realities of demographic trends, this is a change that can be controlled and resisted.

But faculty resistance to technological innovations should not be overemphasized. Major changes always occasion a certain amount of skepticism, even among the most progressive elements in society. It can be helpful in insuring that the proper safeguards are taken. The newest of these technologies has been with us for

less than a decade. With exceptional track records so far, technology's general acceptance in the long run seems virtually assured.

Several measures can encourage acceptance of these technologies among faculty members and others who are committed to our current delivery systems. Wise and adaptable faculty will likely become involved with the evolution of this complementary set of services and will either prepare themselves for responsible positions in the new order or will work to clarify those services that cannot be provided by the technologies and specialize in the provision of them.

A better understanding of the capabilities of the technologies will help to defuse resistance. By insuring faculty involvement in the evaluation and development of software, and by rewarding them with recognition and incentive pay for the energy they invest in this area, states can do much to abolish negative attitudes.

Direct faculty involvement helps to improve attitudes and strengthen commitment toward the technologies. "Young faculty worry most," says Larry Fewell, Telecommunications Coordinator for the Ohio Board of Regents. "The older, more senior faculty have a different perspective: they want to leave something for posterity." When faculty in campus leadership positions become successfully involved in the use of these media, their peers are more comfortable with these learning approaches.

Need for Staff Development

There is a general recognition of the need to train faculty and administrators in the proper use of these technologies. Most consortia of telecourse producing and using institutions offer staff development seminars as a service to their members. A number of professional associations, including the Society for Applied Learning Technology (SALT) and the American Council on Educational Technology (ACET) sponsor conferences and training sessions for their association members.

In the main, however, staff development activities are focused primarily upon those who are already committed to these technologies. More must be done to bring others into the fold. There is a need to foster a closer exchange of information and experiences among technicians, instructional designers, and traditionally-prepared postsecondary faculty and administrators.

Lack of Consumer Readiness

Some observers have expressed concern about how the new technologies will be received by their ultimate beneficiaries, the learners. While there is general recognition that a new breed of video-gaming "computer kids" is evolving in this country, there are fears that the technology will not be used on the scale necessary to insure its cost effectiveness until a much higher level of computer literacy has been achieved, and that still seems to be many years away.

Webster (1975) has described a number of personal barriers that operate to deter individual use of these technologies, including:

1. Lack of personal motivation.

2. Lack of knowledge about the availability of this resource.

3. Sociocultural considerations, which are manifested when the concept of a "refrigerator" appears in the software, but the learner does not really have any experience with such an appliance.

4. Sociolinguistic considerations, as when the language of the software is beyond the level of sophistication of the learner.

Some critics contend that self-paced, space- and time-free, home-bound learning leads to procrastination in many individuals, but there are ways to avoid that problem short of forcing learners to report to a classroom where they would yield to the authority of an instructor/supervisor. Techniques used by open learning advocates include:

1. Requiring that the learner mail in written assignments, exercises and quizzes on a regular basis, perhaps weekly.

2. Requiring periodic meetings with instructors, some of whom prefer to travel to the learner's local community.

3. Using networks of local tutors/learning facilitators to confer with the learner in the local community on a regular basis.

4. Encouraging learners to meet locally in "peer clusters," where they exchange ideas and information, and update each other on their progress.

5. Encouraging learners to maintain telephone contact with their instructors.

6. Issuing weekly broadcasts on radio or television to help the learner pace him/herself.

7. Employing interactive computer systems, such as the RSVP system in use at Miami-Dade Community College, to give learners immediate feedback on how well they are doing, as well as prescriptions for improving their study skills.

8. Publishing periodic newsletters to keep learners informed of developments and to suggest additional learning activities.

Inequitable Access to Technologies

Market Data Retrieval, Inc. recently surveyed 15,000 school districts to determine how many and what types of districts are purchasing microcomputers. The survey revealed that wealthier school districts were twice as likely to acquire them as poor

districts (Education Commission of the States, 1982). One of the most troublesome aspects of this technological era, the survey reports, is that most advances are being made in the for-profit, private sector. Hence, the primary means of financing these developments has been client fees.

Considering the disparities in education levels between rich and poor Americans, it is clear that those who need access to these resources most can least afford them.

Among the strategies that states might employ in working to offset the negative effects of an inequitable distribution of the new technologies are:

1. Supplying public subsidies for hardware and software acquisitions for poor school districts.

2. Encouraging the involvement of historically underserved groups in the production and distribution of software.

3. Providing tax incentives to encourage private manufacturers of the new technologies to make these resources available to the poor.

Technical Limitations of the Devices

Several of the factors that inhibit the expanded use of the new technologies result from the nature of the technologies themselves.

1. Broadcast frequencies are limited, and frequency allocations for education are even more limited. The

move to more sophisticated transmission systems, such as satellites, has helped open up channel space, but satellites with sufficient solar energy generating capacity to meet today's needs are costly to build and launch. Scientists are already planning to increase the number of orbiting satellites.

2. Microcomputers, while useful and increasingly cost effective, lack the data storage capacity of larger computers and would not be useful for certain purposes.

3. The presence of electricity or of very durable batteries is essential to the operation of the most advanced technologies. Underdeveloped communities that lack an adequate supply of this power source would be handicapped in the use of the technologies.

4. Geography and climatic variations can be disruptive to transmissions in various communities. Greater control over weather conditions or strategies for circumventing adverse conditions might be necessary before certain of these technologies can be used with maximum effectiveness.

5. A lack of standardization in the design of technological equipment could seriously limit its usefulness. In the computer industry, for example, the tendency has been for each manufacturer to design software that can only be run on the hardware the manufacturer sells, thus "locking in"

the consumer. Fortunately, this problem is being overcome. Through a process called "emulation," some computers can be adapted for software that has been produced by a variety of manufacturers.

6. Currently, most communications transmissions are being handled by costly, bulky coaxial cables, underground, undersea or along telephone posts. Data transmission by these means is not always reliable because of poor maintenance of cables, adverse weather conditions or other interference. The introduction of "fiber optics" technology, in which data is transmitted in the form of light through glass fibers that are no thicker than a human hair, will eventually reduce current transmission costs and greatly increase their reliability.

Political/Ideological Considerations

In certain corners of the world, political leaders are very conscientious about thwarting propagandists who might take advantage of these technologies to incite unrest. They might also be interested in controlling the information their constituents receive. Hence, the availability of information in an "open learning" environment could provoke serious opposition from authority figures in given communities.

Americans are far less subject to the blatant "thought control" tactics common under fascist governments, but there are more subtle ways to influence opinion that might prove just as damaging.

Ultimately, our personal values have a great deal to do with how effectively we utilize the new technologies.

Public Policy Restrictions and Implications

A variety of policy considerations will have to be addressed before the full potential of the new technologies can be realized. Many of these issues are identified below.

The expanded use of the new technologies need not await the resolution of all of these issues. Indeed, many of them will not be solvable until states have gained certain insights from practical experience with open learning approaches:

1. How should postsecondary accrediting agencies respond to the realities of interstate broadcasts of instructional programs?

2. How will the new technologies affect the state education funding formulae?

3. How will distant learners finance their studies in the future?

4. In the absence of government support, how can we insure that pressure to build an open learning funding base will not undermine the primary role and mission of traditional schools, colleges and universities?

5. To insure efficiency and effectiveness in the use of the new technologies, what types of cooperative arrangements need to be forged among educators, broadcasters, public

utilities, equipment manufacturers and others who are vital to the telecommunications enterprise?

6. Who should be responsible for the coordination of mediated instruction at the state level?

7. How can states insure that interstate broadcasts of televised instruction comply with their standards of academic quality?

8. What measures should be taken to insure that personal information in computer banks is not abused?

9. What are the implications of the 1976 Copyright Act for software development and use?

10. What new evaluation strategies will be needed to assess the impact of media instruction?

11. Who should be responsible for insuring the quality of media software?

12. How will the public be protected against potential abuses, such as subliminal advertising, in instruction programs?

13. What safeguards should be established to insure that differing views and opinions will find expression on centrally-controlled broadcast facilities?

14. How can the education community most effectively cooperate, rather than compete, with private business in the development and dissemination of the new technologies?

Need for More Research

Legitimate questions remain unanswered about the applicability of the new technologies to education, and these tend to fuel resistance to change in this area. For example, we need to know more about the impact of various devices and software on the learning performance of different types of consumers. There is a great deal of concern about avoiding the possible consequences of "technological isolation" when humans interact with machines, rather than other humans.

Much of the needed research is being done in the private sector among producers of the new technologies; but, in general, the research is lagging far behind the pace at which these innovations are being developed and disseminated. Since federal support for research and evaluation in this area is extremely limited, states might want to consider investing directly in further research and evaluation, either individually or through some national consortial arrangement.

While it is important to try to anticipate possible negative consequences of any major innovation, it is equally important to recognize that too much advance analysis can be paralyzing and can sometimes serve only to forestall needed improvements. Furthermore, certain research needs cannot be met until we have

gained more practical experience through the actual use of the technologies.

Conclusion

Much remains to be done before the new technologies are developed to the extent that states can take optimal advantage of them, but state education leaders should not stand idly by while others put the finishing touches on these learning innovations. Education policy makers should regularly inform themselves of the progress of these developments and assume an active role in the evolution of these new teaching/learning tools, to insure that they mesh with long-term state education plans and policy directions.

State education leaders can begin immediately to lay the foundation for a more general acceptance of the new technologies among faculties, students and the public-at-large by providing training and orientation services that help them prepare for the the broader use of mediated instruction.

THE STATE ROLE IN PROMOTING THE USE OF THE NEW TECHNOLOGIES

Possible State Roles

After a careful consideration of the advantages to be gained by a statewide commitment to the use of mediated instruction and an assessment of the hurdles to be overcome, it is appropriate to identify specific roles for states. Such roles might include:

1. Defining state goals that can and should be addressed through an extension of adult learning opportunities.

2. Collecting planning data and monitoring developments in the field of telecommunications, both within the state and nationally.

3. Serving as an arbiter of interinstitutional disputes related to the use of the new technologies.

4. Coordinating the delivery of training services by schools and colleges for private business and industry.

5. Building public support for open learning activities by keeping the public informed of developments in this area.

6. Assisting in evaluating the fiscal and education impacts of the new technologies.

7. Drafting statewide plans for maximizing the use of available resources in this area.

8. On behalf of the postsecondary institutions within the state, coordinating the production, acquisition and distribution of equipment and software.

The first of these roles, state goal setting, is particularly important. As was noted in the introduction to this paper, states achieve greater economy in the use of these technologies by encouraging the greater use of instructional approaches that are both cost effective and learning effective, and by carefully selecting the instruction priorities for public support.

State Goal Setting

States will vary considerably in the goals they select and in the specific instruction strategies they use to attain those goals. While no attempt will be made here to provide an exhaustive list of state options, a few examples of areas in which state goals might be identified and reached through the cost-effective provision of adult learning services might be helpful.

Economic Development

States clearly have the ability and the responsibility to foster their own economic development. This includes extending tax incentives to attract new firms and stimulate productivity in the business community, and marketing the state's business advantages in the commercial world. But the most significant and lasting responses to our economic woes require a commitment to human resources development ("human capital development"). States

can encourage private sector support of manpower training programs; aid in the planning, coordination and evaluation of training programs; and support the provision of early school preparation that helps to insure that future workers will be able to make the transition into a more technological work force.

Promoting Equity

Nationally, most adult learners are young, White and relatively affluent. The gulf between America's education "haves" and "have nots" is much wider among adults today than it is among youth. The cost of entitlement programs that provide subsistence for dependent adults is already a major drain upon our state and national economies, and can be expected to have an even more devastating effect in the future, unless something can be done to maximize the self sufficiency of all Americans. Further education and training offers the best opportunities for accomplishing that goal.

Promoting Wellness

State expenditures in the area of public health and hospital administration have been rising steadily in recent years. For want of adequate preventive health care, relatively minor ailments are often neglected until they become life threatening or permanently crippling disorders. Employee absenteeism related to illness costs our economy millions of dollars in productivity each year, and the failure of individuals to adequately care for themselves during their early lives renders them wholly dependent

upon society for help in meeting the high medical costs that often characterize their later years.

Americans are living longer than their forefathers, but that advantage translates into a protracted health care liability for society when they do not know how to keep themselves free from illness.

These are concerns that states will want to address, despite diminished resources. All of them can be diminished through public support and encouragement of some form of adult learning. The more efficiently adult learning is provided, the greater the economic advantage to the state.

A Strategy for Implementing State Goals

Once a state goal has been defined, a systematic approach should be used in the application of cost-effective instruction technologies to the achievement of that goal. Webster (1975) suggests the fundamentals of such a systematic approach, which the author has adapted for the purposes of this discussion:

1. Careful studies should be made of the working environment in which cost-effective reforms are to be effected. In a goal such as promoting wellness, this would involve identifying appropriate content for instruction programs; and gathering data about the level of sophistication, the mobility patterns and the interests of the population, so that appropriate dissemination strategies might be devised.

2. The social and education objectives for each goal should be accurately defined. Objectives under a general goal of promoting wellness might include:

   a. Familiarizing the public with available health screening facilities.

   b. Teaching people to conduct self-diagnoses, so that they can determine their vulnerability to certain afflictions, such as breast cancer.

   c. Teaching people the importance of diet and how to prepare well-balanced meals.

   d. Informing the public of the potentially devastating, long-term effects of the consumption of dangerous substances, such as alcohol, nicotine and other drugs.

3. The appropriate methods and media for use in the achievement of each of the above four objectives will have to be selected. Certain of these objectives might best be achieved through the development and dissemination of televised public service spots; others could be addressed in radio broadcasts, so they can be heard by persons who are driving trucks or otherwise prevented from engaging in passive television viewing;

and still others might be addressed through the use of printed media (newspapers, magazines, pamphlets and so forth).

4. Once the technological options for achieving each objective have been identified, proponents of the new technologies should begin the process of relating the two, starting with the least complicated and least costly approaches. Producing a half-million-dollar education film might serve the purpose of educating people to the importance of diet very nicely; but, if that same objective can be achieved by investing $20,000 in the publication and statewide distribution of a pamphlet, the interests of the state are best served by employing the latter approach. Webster refers to the selection of less-than-optimum approaches as using "intermediate technologies"; another Englishman, E. F. Schumacher, refers to it as "appropriate technology."

5. Whatever approach is ultimately adopted for the achievement of specified objectives should be carefully evaluated to insure that it meets the requirements of the state goal. Such evaluation should be alert both for evidence of the success of the chosen strategy and for evidence of unanticipated problems.

Most of these elements are reflected in a preliminary plan that was developed by a technical advisory committee on telecommunications, recently appointed by the California Postsecondary Education Commission (CPEC). That document might serve as a model for planners in other states. The only step not fully addressed in the CPEC plan and typically not addressed in American analyses of the needs and potentials of the new technologies is the idea of "appropriate technology." Most Americans who are reasonably well informed on this subject tend to be enamored with the most sophisticated and most costly of the technologies.

Conclusion

The new technological innovations offer states a rare and important opportunity to streamline the cost of essential education services, but state policy makers must fully understand how these resources can be most wisely used and must resist the temptation to adopt the most glamorous forms of the technologies, where other approaches would be both more cost effective and more qualitative.

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